

Claims

1. A fuel cell, comprising:

an anode support plate and a cathode support plate and a membrane electrode assembly disposed between said anode and cathode support plates, said membrane electrode assembly comprising a polymer electrolyte membrane, at least one of said support plates comprising a hydrophilic substrate layer having pores therein:

10 a water transport plate adjacent to each said hydrophilic substrate layer, each said water transport plate having a passageway for a water stream and another passageway for a reactant gas stream; and

15 a partially hydrophobic porous carbon fluoropolymer particulate composite diffusion layer disposed between at least one said hydrophilic substrate layer and said membrane electrode assembly, each said diffusion layer comprising about 10% fluoropolymer by weight.

2. A fuel cell according to claim 1 wherein:

5 said diffusion layer comprises a fluoropolymer selected from the group consisting of polytetrafluoroethylene, fluorinated ethylene propylene, polytetrafluoroethylene-co-perfluoromethyl vinyl ether, copolymers of ethylene and tetrafluoroethylene, copolymers of ethylene and chlorotrifluoroethylene, polyvinylidene fluoride, polyvinyl fluoride and amorphous fluoropolymers.

3. A fuel cell, comprising:

an anode support plate and a cathode support plate and a membrane electrode assembly disposed between said anode and cathode support plates, said membrane electrode assembly

5 comprising a polymer electrolyte membrane, at least one of said support plates comprising a hydrophilic substrate layer having pores therein;

10 a water transport plate adjacent to each said hydrophilic substrate layer, each said water transport plate having a passageway for a water stream and another passageway for a reactant gas stream; and

15 a diffusion layer disposed between at least one said hydrophilic substrate layer and said membrane electrode assembly, the thickness of each said diffusion layer being more than about 5.0 microns and less than 25.0 microns.

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4. A fuel cell, comprising:

an anode support plate and a cathode support plate and a membrane electrode assembly disposed between said anode and cathode support plates, said membrane electrode assembly

5 comprising a polymer electrolyte membrane, at least one of said support plates comprising a hydrophilic substrate layer having pores therein;

10 a water transport plate adjacent to each said hydrophilic substrate layer, each said water transport plate having a passageway for a water stream and another passageway for a reactant gas stream;

a diffusion layer disposed between at least one said hydrophilic substrate layer and said membrane electrode assembly; and

means for creating pressure differential between said reactant
15 gas streams and said coolant stream such that the pressure of each
said reactant gas stream is greater than the pressure of said coolant
stream, said pressure differential being more than 0.2 psi and less
than 1.7 psi.

5. A fuel cell, comprising:

an anode support plate and a cathode support plate and a
membrane electrode assembly disposed between said anode and
cathode support plates, said membrane electrode assembly
5 comprising a polymer electrolyte membrane, at least one of said
support plates comprising a hydrophilic substrate layer having pores
therein;

a water transport plate adjacent to each said hydrophilic
substrate layer, each said water transport plate having a passageway
10 for a water stream and another passageway for a reactant gas
stream; and

means for creating pressure differential between said reactant
gas streams and said coolant stream such that the pressure of each
15 said reactant gas stream is greater than the pressure of said coolant
stream, said pressure differential being more than 0.2 psi and less
than 1.7 psi.